



National Aeronautics and  
Space Administration

## Pluto and Charon





**PLUTO** is unique among the planets. It's the smallest, the coldest, and the farthest from the Sun. Its orbit is the most elliptical and tilted, and it's the only planet that has a moon close to its own size. Because of its great distance, Pluto remains the only planet that has never been visited by spacecraft.

Pluto wasn't discovered until 1930, when American astronomer Clyde Tombaugh first captured it in photographs. Because of its faintness, several decades elapsed before much was learned about Pluto. However, beginning in the late 1970s, as astronomical instrumentation and telescope technology began to advance rapidly, so did number of things known about Pluto.

We now know Pluto's diameter is much smaller than was believed at its discovery. In fact, Pluto is only about 2,400 kilometers across, which means that Pluto is smaller than Earth's moon! Pluto's surface, which is slightly reddish, is made up of exotic snows, including methane, nitrogen, and carbon monoxide. Evidence indicates that Pluto's interior consists primarily of rock and water ice. Above the planet's surface lies an atmosphere, which is not very dense; the atmospheric pressure on Pluto is just one millionth that on Earth. Although the atmosphere is much more tenuous than Earth's, Pluto's low gravity (about 6% of Earth's) causes the atmosphere to be much more extended in altitude than our planet's. Because Pluto's orbit is so elliptical, Pluto grows much colder during the part of each orbit when it is traveling away from the Sun. During this time, the planet's atmosphere collapses onto the surface in a planet-wide snow storm.

In 1978, American astronomers James Christy and Robert Harrington discovered that Pluto has a satellite (moon), which they named **CHARON**. Charon, which is almost half the size of Pluto, orbits the planet every 6.4 days, at an altitude of about 18,300 kilometers. Given the rough similarity of Pluto's size to Charon's, most planetary scientists refer to Pluto-Charon as a double, or binary, planet. Charon's surface differs from Pluto's; it is covered with dirty water ice and doesn't reflect as much light as Pluto's surface. Also, Charon's surface is devoid of strong color, and there is no confirmed evidence for an atmosphere on Charon.

In the late 1980s, Pluto and Charon underwent a set of mutual eclipses in which each body passed in front of the other repeatedly for several years. This pattern of events can be seen from Earth every 124 years, and will next begin in 2109 AD. Based on data from these eclipses and sophisticated computer models, it was possible to make crude maps of each body. From these maps it was learned that Pluto has polar caps, as well as large, dark spots nearer its equator. Because Pluto is so small and far away, it is impossible for any telescope on Earth to directly see these features. By getting above Earth's blurring atmosphere, the Hubble Space Telescope was capable of imaging Pluto and its moon Charon in early 1994.

Today, questions such as "How were Pluto and Charon formed?" Why are they so small and different from all other planets? still remain. One leading theory suggests that Pluto and Charon are relics of a population of hundreds or thousands of similar bodies that were formed early in solar system history. According to this hypothesis, most of these bodies were ejected to much larger distances from the solar system by the gravitational influence of the giant planets. The recent discovery of several bodies approaching the size of Charon in the region beyond Pluto has bolstered this theory.

Although no spacecraft mission has been sent to Pluto, NASA is presently working with scientists around the United States to discuss and evaluate plans for a mission to explore this strange double planet. The *Pluto-Kuiper Express* mission will entail using two highly miniaturized spacecraft to fly past the Pluto/Charon system and conduct a reconnaissance of the only major planet that has never been visited by a spacecraft. Projected to reach Pluto/Charon sometime around 2010 or later, the two flyby encounters will be timed to view opposite hemispheres of the slowly-rotating Pluto. Following the Pluto/Charon encounters, the spacecraft will be retargeted to survey a diverse collection of icy bodies, the so-called "Kuiper Belt Objects."

## Fast Facts

<b>Namesake</b>	Roman God of the Underworld
<b>Average Distance from the Sun</b>	6 Billion Kilometers
<b>Orbit Period</b>	248 Years
<b>Equatorial Diameter</b>	2,400 Kilometers
<b>Atmosphere (Main Constituents)</b>	Nitrogen, Carbon Monoxide, Methane
<b>Inclination of Orbit to Ecliptic</b>	17.2°
<b>Eccentricity of Orbit</b>	0.25
<b>Rotation Period</b>	6.387 Days
<b>Inclination of Axis</b>	~120°
<b>Moon</b>	Charon
<b>Charon's Diameter</b>	1,210 Kilometers

## Significant Dates

- 1930 — Pluto is discovered.
- 1955 — Pluto's 6.4. day rotation period is discovered.
- 1976 — Methane on Pluto's surface is discovered.
- 1978 — Charon is discovered.
- 1985 — Onset of Pluto-Charon eclipses (lasted 1985-1991).
- 1988 — Pluto's atmosphere is discovered.
- 1992 — Nitrogen and carbon monoxide on Pluto's surface is discovered.
- 1994 — First Hubble Space Telescope maps of Pluto.
- 2010 — Predicated atmospheric collapse.

## About the Image

*This is the clearest view yet of the distant planet Pluto and its moon, Charon, as revealed by NASA's Hubble Space Telescope (HST). The image was taken by the European Space Agency's Faint Object Camera on February 21, 1994 when the planet was 2.6 billion miles (4.4 billion kilometers) from Earth; or nearly 30 times the separation between Earth and the Sun.*

### References

- 1) Views of the Solar System—Pluto  
<http://bang.lanl.gov/solarsys/pluto.htm>
- 2) Planetary Photo Journal: <http://photojournal.jpl.nasa.gov/>
- 3) Stardate, The University of Texas at Austin, McDonald Observatory, 2609 University Ave., #3.118, Austin, TX 78712